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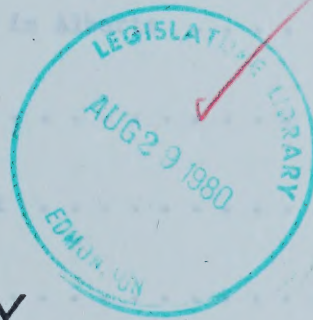
GUIDELINES FOR THE ORDERLY DEVELOPMENT
OF THE COMMERCIAL PEAT INDUSTRY IN ALBERTA

A REPORT SUBMITTED TO
THE CONSERVATION AND UTILIZATION COMMITTEE

June 11, 1974

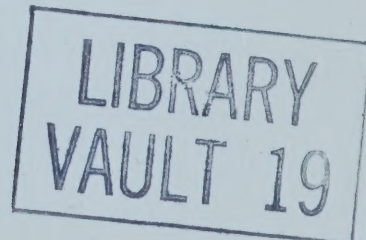
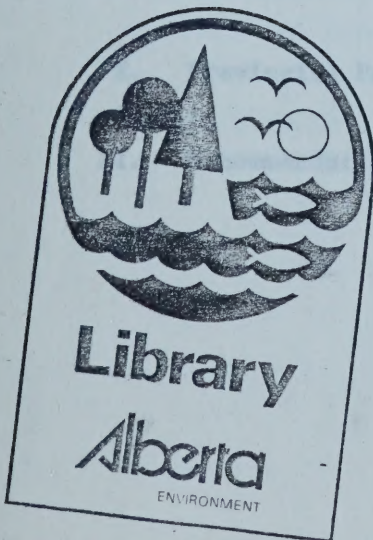
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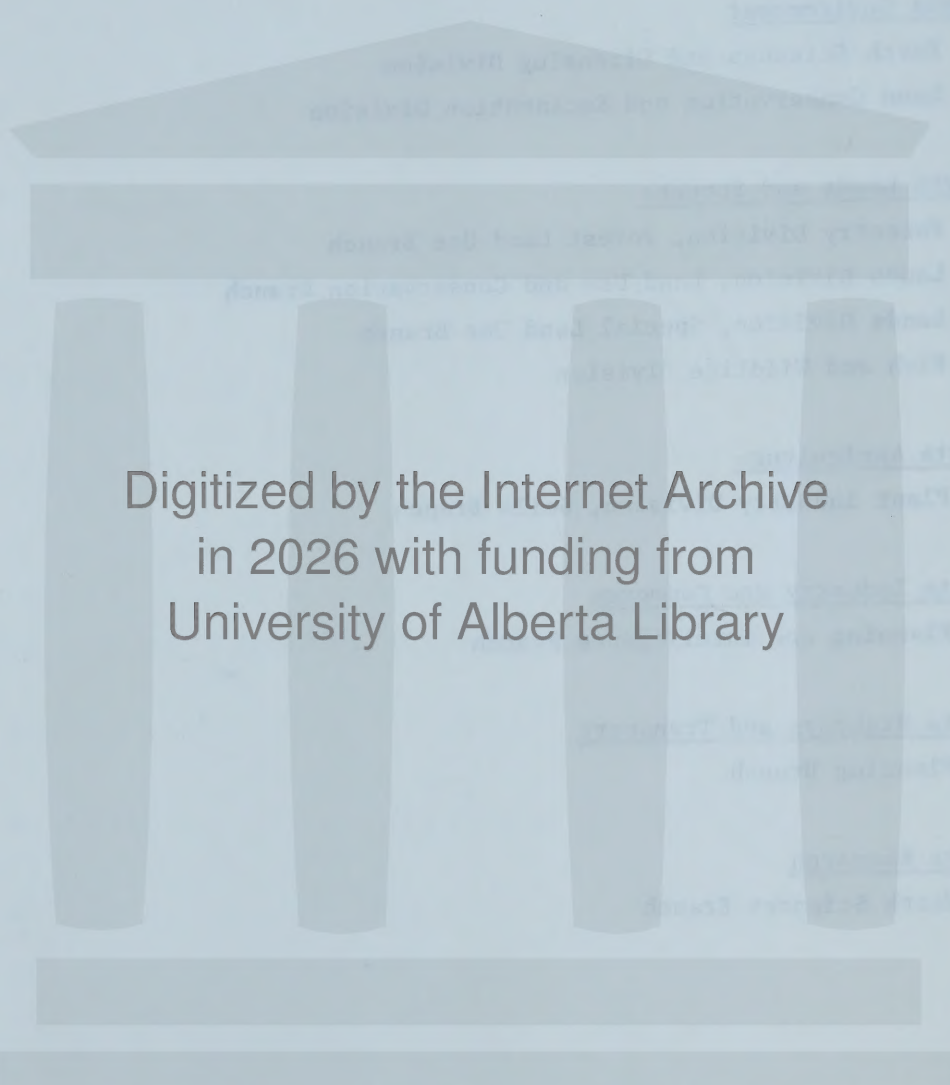
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I.

INTRODUCTION

Although the removal of peat from various locations in Alberta is not a new practice, the commercial peat industry in this province may still be considered to be in its infancy. Only after years of frustration have operators begun to develop markets, overcome problems of excavation and provide transportation of their product to market. Some problems have been overcome, others appear more difficult. The industry realizes its potential and is continuing to expand.

As the demand for peatland increases, the government is becoming aware of its responsibility to ensure that proper guidelines are set down along which the industry may expand in an orderly fashion. Most peatlands are owned by the crown. As land managers, we must have a working knowledge of the commercial peat industry in order to formulate these guidelines. This report attempts to provide part of this background and hopefully will shed some light on the kind of guidelines that are needed at this time.

The purpose of this report is not to provide an extensive assessment on the reclamation and environmental impacts of peat mining as this would be a topic requiring considerable research.

II. THE FORMATION AND CHARACTERISTICS OF PEATLANDS

The formation of peat deposits takes place in undrained or poorly drained terrain. Only certain plants can grow in this type of terrain, and their continued existence is dependent upon adequate rainfall or groundwater discharge and a low rate of evaporation. Such plants as sphagnum and hypnum mosses, and certain grasses, shrubs, and sedges are the predominant growth under these conditions.

As these plants die the high level of water excludes atmospheric oxygen, thus preventing the normal aerobic decomposition of the plant. Decomposition proceeds at a very slow rate and the plant form disintegrates, this process being termed humification. As the years progress, successive annual layers of plant debris increases the thickness of the peat deposit. The rate of growth, of course, is a function of latitude, altitude, and climate and so amounts of biomass increase each year will vary. In Alberta, it is safe to say that, at present rates of growth, peat deposits are considered to be non-renewable resources.

III.

TYPES OF PEATLAND IN ALBERTA

The large area of Alberta commonly known to us as "Muskeg" may be divided into two basic forms of peatland: fen peatlands and bog peatlands. A good understanding of the properties of these two forms will aid in this study.

Fen peats receive their moisture from ground water. They develop in topographic depressions which are usually gently sloping, allowing seepage water to percolate downslope. The fens are affected by runoff water from nearby mineral soil areas and by the downslope movement of this water. This constant slow movement of water maintains fairly high levels of nutrients in the peats and tends to oxygenate them fairly well. As a result, fen peatlands are usually moderately to well decomposed and relatively high in nutrient qualities. The pH is usually neutral or slightly acid. Fen peats may be subdivided into several terrain types (Fenlands). One such broad type occurs in ponds which are filling in with plant remains. Other types occur on very gentle slopes (estimated at less than 1 in 5000) as rivers of grass (sedge) where slowly seeping water saturates the entire deposit. Often, narrow ridges develop at right angles to the direction of seepage, forming string (ribbed) fens. See fig. 1.



Other forms of vegetation include alders and willow

Bog peatlands are sufficiently raised above the level of the neighbouring wetland that their surface receives only rainwater and is largely unaffected by the water of the nearby wetlands or by runoff from the mineral soil landscape. Thus, they are largely stagnant, poorly decomposed and low in nutrients. The peat in bog peatland is most acid near the surface (pH about 4.5) but the acidity decreases with depth to about pH6 near the base. Other forms of vegetation in Bog peatlands are restricted to acid tolerant species such as black spruce, labrador tea, sheep laurel and blueberries. See figs 2, 3, and 4.

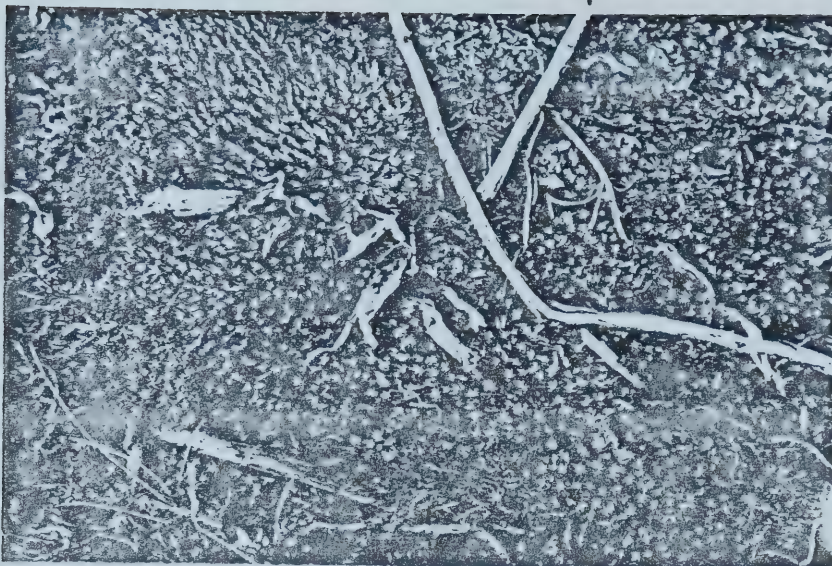


Fig. 2 Sphagnum Moss

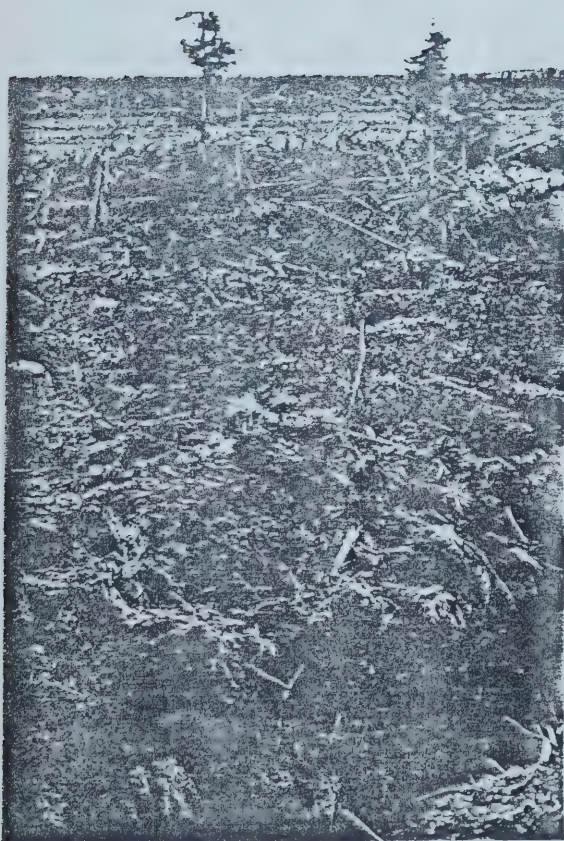


Fig. 3 Typical vegetation
in Bog Peatland

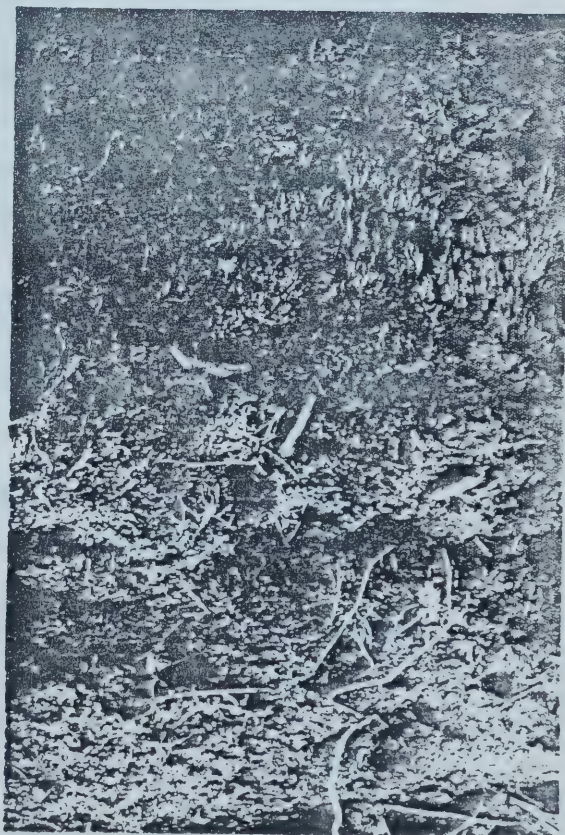


Fig. 4 Layered Sphagnum Moss along
drainage ditch. Note living
and dead moss

Bog peatlands (Boglands) may also be divided into several terrain types. Bog plateaus, which develop on mineral soil raised up from neighbouring fens or pools, are one type. The moisture supply is derived mainly from the atmosphere, and depths are usually not too great (around three feet). This type of bog is found commonly in Quebec. Once removed, the underlying mineral soil may have potential for agricultural production. Another terrain type, possibly the main pattern of growth of Boglands in Alberta, is on top of existing Fenlands. Fenlands eventually reach the point in their water balance where groundwater and atmospheric water sources are not sufficient to maintain aggressive growth on fen plants. Bog plants, with fewer nutrient and water requirements, establish as small islands on top of the Fen peats. Nutrient exchange between Fen and Bog are minimized because decomposition of the fen peats produces an oxidized zone between the two layers which is relatively impervious. This zone often appears as a layer of dark, jelly-like ooze. If the area once again becomes flooded, the situation may reverse itself, with a Fen peat developing on top of a Bog peat (which in turn developed on a Fen). It is important to realize the mixed peat layers which may exist in an area proposed for commercial peat moss development. Each layer has different properties which may require different excavation techniques, equipment, and have different markets. This layering effect makes identification of potential commercial peatlands a problem, and necessitates detailed probing.

A typical vertical section of a peat deposit may be described as follows:

- | | |
|---------------------------------|---|
| <u>Bog</u>
<u>Properties</u> | <ol style="list-style-type: none">1. A bed 6-12 inches thick of living sphagnum mosses, overlying 6-10 feet of unhumified dead moss which is known as peat moss;2. A bed of well humified woody peat, containing partly decomposed stumps and roots; |
| <u>Fen</u>
<u>Properties</u> | <ol style="list-style-type: none">3. Beds of reed and sedge peat, formed by humification of reed or sedge plants and,4. A layer of dark jelly-like ooze, sometimes called sedimentary peat, resting on a clay or silty bottom. |

IV. TECHNIQUES TO IDENTIFY COMMERCIAL PEAT RESERVES IN ALBERTA

At present the best way to locate and identify potential commercial peat reserves in the province is to go through the following procedure:

1. Use soil survey maps or forest cover maps to identify depressional, wet areas. Soil survey maps will typically outline the type of organic soil.
2. Obtain aerial photographs for the selected areas. Organic terrain is distinguished from mineral soil on the air photograph by the texture or grain, or by identification of the type of cover. With the help of a stereoscope, the size, accessibility, density of growth, topography, and drainage pattern can be determined. In some instances it is possible to differentiate bogs that are too shallow to be of interest, especially in cultivated areas.
3. Carry out field investigations to determine volume of commercial peat available, access problems to be overcome, quality of raw product, transportation costs, etc.

Another method suggested for the identification of commercial peat deposits is the use of color photography, thermal photography, and infra-red techniques. Studies done to date however, suggest that these techniques, based on either color or temperature differences, do not present acceptable alternatives to conventional black and white photography. Texture appears to be the key to identification and assessment of potential commercial peat areas. Color photographs lose some textural qualities, and the thermal and infra-red techniques produce interpretation problems due to varying field conditions (ie. moisture levels, presence of ice formation).

Below is a method of selecting bogs for examination suggested by T. E. Tibbeth of the Coal and Peat Preparation & Surveys Section, Department of Mines and Technical Surveys, Ottawa.

Method of selecting peat bogs for examination*

Air photos, obtained from the National Air Photographic Library and from provincial governments, and topographical maps, obtained from the Surveys and Mapping Branch, Department of Mines and Technical Surveys, of recorded bogs are examined.

Areas of organic terrain exhibit features on air photographs which permit of easy identification, namely:

- (1) They usually occur in local depressions.
- (2) They are usually characterized by dense forest growth with local open areas.
- (3) Open bog areas which could contain peat are usually rimmed by a thick shrub growth and alder and poplar stands, succeeded towards the open area by spruce trees.
- (4) If no spruce trees are present, either thick, low bush grows between the deciduous trees and the open area, or a mixture of all three growth types is present.
- (5) Organic terrain is distinguished from mineral soil on the air photograph by the type of cover, texture or grain.
- (6) If a bog is too shallow to be of interest for peat moss production, this fact can sometimes be distinguished on air photographs by the gradual merging of shading and textural contrast between the organic and mineral soils. Cultivation seldom enters the area of heavy growth rimming a deep bog.

In this way, and with the help of the stereoscope and topographical maps, the size, accessibility, density of growth, topography and drainage pattern can be determined. In some instances it is possible to distinguish bogs that are too shallow to be of interest. The selection of bogs for field examination is made from the above information on the basis of surface growth, drainage and area. Below are some of the considerations:

Surface growth: Other things being equal, the fewer the trees that grow on a bog, the lower will be the cost

* T.E. Tibbeth, Coal and Peat Preparation & Surveys section,

of preparation. Particular attention is paid to those bogs that are essentially free of trees.

Drainage: The cost of drainage is an important factor in bog development. Topographic maps are examined to determine the feasibility of drainage. Bogs adjacent to lakes and rivers represent a prohibitive development cost if they are at the same elevation as the adjacent water.

Area: The bog area required depends on the depth of the moss and on the scale of production anticipated. To be commercially attractive on other than a part-time basis, a supply to support a production in the order of 150,000 six cu. ft. bales per year should be considered. Assuming a minimum depth of five feet (1.52 m) and a settling of two feet (0.61 m) due to drainage, one acre contains 130,680 cu. ft. (3700 cu m). Assuming a volume of 150 cu. ft. (4.2 cu m) per ton for air-dried peat, there are present 871 tons per acre. This is equivalent to 21,780 bales, or sufficient supply production for 0.14 years. Based on the above estimates, 75 to 100 acres of open bog are taken as minimum prerequisite area.

Field and laboratory evaluation

If from the examination of air photos and topographical maps it appears that a peat bog may meet the requirements of area, cover, drainage, depth, etc. for feasible development, field and laboratory investigations are made. This consists of a preliminary survey to gain familiarity with the area and to verify information gained from air photos and maps, followed by sampling and analysis.

Sampling

The general procedure that is followed in establishing sampling areas of a bog is to select three locations forming the apices of a triangle, the distances between them being from 1,000 to 1,550 feet (305 to 457 m). The pace-and-compass method is used for locating the points, and these are connected by reference to topography on aerial photographs. If the result warrant, additional sample areas are selected. The sample areas are then plotted on aerial photographs at the scales indicated.

In the field the samples collected are examined and certain physical characteristics are briefly noted. Particular attention is given to the colour and texture to give an indication of the degree of humification. The latter is, within wide limits, further indicated by a simple test described by Rigg. In this test a quantity of peat material is pressed in the hand and observation is made of what comes out between the fingers and what remains in the hand. If nothing but clear water comes out, humification has not begun. If all of the material comes out and nothing is left in the hand, humification is almost complete. There are stages between the extremes, indicated by such words as slightly, somewhat or moderately humified. The fibrous unhumified stage is termed peat moss, and the final stage is noted as peat fuel.

Consecutive samples of similar material are grouped as one. Each sample is identified in regard to location and depth.

Loss of moisture in samples between the field and laboratory is minimized by using readily sealable plastic bags.

A sample of about 500 grams of raw peat is desirable for testing purposes.

Analysis

Our qualitative evaluation of peat moss is carried out with the use of the material in mind for agricultural and horticultural purposes.

Benefits from the use of peat moss in agriculture - for litter purposes mainly - are derived mainly from the absorptive capacity. The

ability of peat moss to absorb moisture is also of prime importance in evaluating the material for use in horticulture. It is unfortunate that no standardized method presently exists for measuring this most important property of peat moss, as such a method could eliminate much confusion in the trade and enable comparison of the product internationally.

V.

PROPERTIES AND USES OF COMMERCIAL PEAT

Peat is a valuable product because of its high absorbing capacity of liquids and gases, its high resistance to decomposition, its low heat conductivity, and its high ionic exchange capacity. It is being increasingly recognized for its value as a soil conditioner in the horticultural (nurseries and propagators), market gardening, orchard and vineyard areas of agriculture. The products demanded are diverse according to compactability, moisture holding capacity, texture, ash content, pH, and degree of sterilization. Other uses are:

1. filtering agents for effluent quality control
2. binder for ore concentrate pellets
3. oil absorbent for oil spill control
4. insulating construction materials
5. fuel source for power plants
6. peat pots
7. mushroom culture
8. litter bedding for domestic stock, poultry

Alberta producers, with the variety of raw materials at hand, have the capability to provide specific products for specific markets. Their products can be uniformly prepared for whatever moisture levels, textures, sterilization requirements, pH, and compaction that are demanded. This practice of supply has not been fully developed as yet by most Alberta producers.

VI.

PRODUCTION AND RESERVES

In 1970, Canada ranked sixth among producing nations, (fifth for agricultural peat) with production estimated at 317,000 tons worth \$9.4 million. Production peaked in 1969 at 330,000 tons worth \$9.6 million, but was an estimated 326,000 tons valued at \$10.4 million in 1971.

Quebec and British Columbia are still the leading producers. Alberta output has remained fairly constant in the past few years ranging between 7,000 and 10,000 tons annually. The value of production for Alberta was \$117,000 in 1967 and an estimated \$196,000 in 1971 even though the production figures were essentially the same. Alberta continues to account for between 2% and 3% of the total quantity and value of peat production across Canada. Most of the activity in this Province takes place near Evansburg, west of Edmonton, with lesser activity northeast of Edmonton plus some in the Peace River region.

TABLE 1

APPLICATION FOR PEAT MOSS

NAME	ADDRESS	LOCATION	APP. NO.
Coli F. Huge	Box 1839 Ft. McMurray, Alberta	86-9-4	865
Dechant Alex	Box 627 Manning, Alberta	97-21-5	54-73
Edmonton Engineering Ltd.	604 Northgate Bldg. 10049 Jasper Avenue Edmonton, Alberta	59-10-5	28-73
		59-9-5	28-73
		58-9-5	28-73
		53-8-5	34-73
		53-9-5	34-73
		52-9-5	34-73
		51-9-5	34-73
Midsum Peat Moss Co. Ltd.	1108 - 6th Street S.W. Calgary, Alberta	55-9-5	41-73
		75-19-5	675
		76-19-5	675
		76-20-5	675
		77-20-5	675

TABLE 2

DISPOSITIONS FOR PEAT MOSS

NAME	ADDRESS	LOCATION	LEASE
Arctic Peat Moss Ltd.	1250 Kings Highway Fort Frances, Ontario	62-21-4	1956
Baia & Marcel Maurer	13606-100 Avenue Edmonton, Alberta	53-2-5	1998
*Banff Mining & Quarrying Ltd.	Box 304 Evansburg, Alberta	53 & 54-8-5	2083
Banff Mining	Evansburg, Alberta	53-8-5	2880
*Baycroft Moss Ltd.	13915-109 A Avenue Edmonton, Alberta	53-8-5	2909
Baycroft Moss Ltd.	13915-109 A Avenue Edmonton, Alberta	53-8-5	2826
Caribou Peat Development	Smoky Lake Alberta	60-14-4	2848
Central Alberta Florists Ltd.	5201-43 Street Red Deer, Alberta	42-5-5	2731
*Hood Mfg. Enterprises Ltd.	13322-102 Avenue Edmonton, Alberta	54 - 57 -8-5	2860
Harris Raymond G.	9322-107 Avenue Grande Prairie, Alta.	70-6-6	2141
Gibney Frank	9511-102 Avenue Red Deer, Alberta	70-5-6	2772
Kozub George	Smoky Lake, Alberta	62-17-4	2172
*Williamson Jack	P.O. 126 Valleyview, Alberta	69-22-5	2939

The number of establishments in Canada continued to increase from 56 in 1966 to 68 in 1968 while the number of employees declined from 1,107 to 1,040 over the same period. There were four active peat plants in Alberta in 1971. The output at Saskatchewan's only peat facility at Carrot River has been increasing by leaps and bounds since 1969. That year production was estimated by 400 tons; by 1970 it was 4,000 tons; and by 1971 had surpassed Alberta's output, with a reported 9,000 tons.

The Canadian and Alberta peat industry has been highly geared to the foreign markets, particularly that of the U.S., for a number of years. The 1971 Canadian production of 326,000 tons in 1971 included exports of 274,500 tons virtually all of which went to American markets.

Alberta producer's ship most of their peat to California using trucks. These exports generate close to half a million dollars a year. In 1970, of the 10,000 tons produced, Alberta exported 6,850, according to calculations made by the Alberta Bureau of Statistics. In recent years Canadian exports have been generating between \$12 million and \$13 million per year for the economy.

Outlook

As a natural resource, commercial peat is widely distributed throughout the world and can be exploited with a minimum of equipment and expense. The one area where continued growth in peat production and utilization can be expected world wide is in agricultural and horticultural applications. As world population and food requirements rise, the growing of fruits, vegetables, and cereal crops will require tremendous quantities of soil nutrients and conditioners.

The U.S. demand for peat in the year 2000 has been estimated by the U.S. Bureau of Mines, using 1968 consumption as a base. The range of demand estimated was from 1.2 to 2.4 million short tons with the median 1.8 million short tons. For the rest of the world (outside the U.S.) the range was from 300 to 400 million short tons with the median

at 350 million. Based on constant 1968 dollars the estimated value of peat demand (domestic and imports) would range between \$25 and \$50 million. Population was the indicator used to forecast demand since the major market is the individual home owner. Contingency factors such as increases in per capita consumption, changes in population growth, and shifts in population from cities to the suburbs were included.

In recent years about one half of the total U.S. demand was supplied by domestic production with the remainder coming from imports. In projecting demand to 2000 it was assumed that about 70 per cent of the demand at that time would be supplied by domestic producers.

Demand in the rest of the world is expected to increase at about the same rate as in the U.S. according to the U.S. Bureau of Mines. Future consumption in the rest of the world will be determined by the extent to which peat will be used in the U.S.S.R. as a power plant fuel and for agricultural purposes.

VII. REQUIREMENTS FOR SUCCESSFUL COMMERCIAL PEAT OPERATION

The successful commercial peat operation is a function of five factors:

(1) Markets - solid and long term contracts for product.

Texture and moisture requirements, pH, ash content, and guaranteed delivery are all important in maintaining specific and demanding markets. Thus, specific products for specific uses is the aim of the peat operator. As well, he must maintain a high state of flexibility as market demands due to changing technology and changing prices in a competitive business require that he alter his product. A better degree of quality control is necessary here to obtain and maintain good markets.

(2) Geographic Location

This is an important factor in determining the scale of operation and the improved technology this province requires compared to the remainder of Canada. U.S. markets for Quebec peat are generally within a very few miles of the source. Thus, peat operators can afford to be more labor intensive. Most operations in Quebec are carried out on a part time basis by local farmers with little equipment. A similar situation exists in Ireland where digging with shovels is commonly practised. In both cases, transportation costs to market are low. As well, climates are favorable for drying the product by sunlight. The summer period of operation is, of course, longer than here in Alberta. All operations in B.C., Manitoba, Quebec and the Maritimes have advantages of distance to market and climate when compared to Alberta operations.

(3) Cost of Production

The cost of production is dependant upon:

- (a) availability of capital
- (b) cheap and available land as source of material
- (c) automation and low fuel costs

To offset the glaring disadvantages of climate and distance from market, the Alberta producer must go to larger acreages, cheaper land, quality product, and large volume low cost production. This is similar to the Prairie grain situation. This, in turn, means a requirement for better planning of operations and use of more advanced technology. Alberta operators are inventors, and have tons of scrap metal from equipment they have tried and discarded. They are machine intensive rather than labor intensive. As well, to offset climatic disadvantages, dryers have become a necessary part of successful operations. With natural gas as a source of fuel, (depending on cost, of course) the climatic disadvantage can be overcome. In fact, the potential now exists to dry the product exactly to order. Desired moisture levels for specific peat uses are achievable, thus enhancing the Alberta product. As well, operations have become year round. Operating from stockpiles in the winter insures a continuous flow of product and continuous employment.

(4) Topographic location - drainage

Topographic location is important to consider into drainage costs. For dryland operations, the greater the slope the better and faster the peatland will be drained.

(5) Reclamation Costs

The economics of the commercial peat industry are possibly such that to add stringent reclamation requirements to the operations could well wipe the industry out. However, reclamation should be all the more strongly a consideration when deciding on an operating plan for excavation of a peatland.

VIII. EXTRACTION METHODS AND PLANT OPERATION IN ALBERTA

In Alberta, there are three basic excavation technologies. These are: dry excavation, requiring ditches and drainage; drag-line, requiring ditches and drainage; and the wet method, requiring floating barges.

A. Dry Excavation

This method requires the following sequence of operations and machinery:

1. perimeter ditching (a winter, frozen ground operation using drag-line). See Figures 4, 5 and 6.



Fig. 4 Perimeter ditching before clearing



Fig. 5 Perimeter ditching before clearing

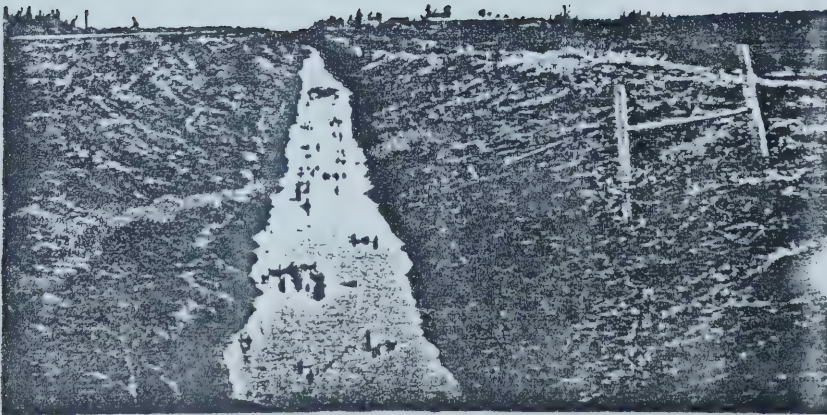


Fig. 6 Perimeter ditching before clearing

2. clearing (frozen ground operation using light cats on wide pads) See Figure 7.

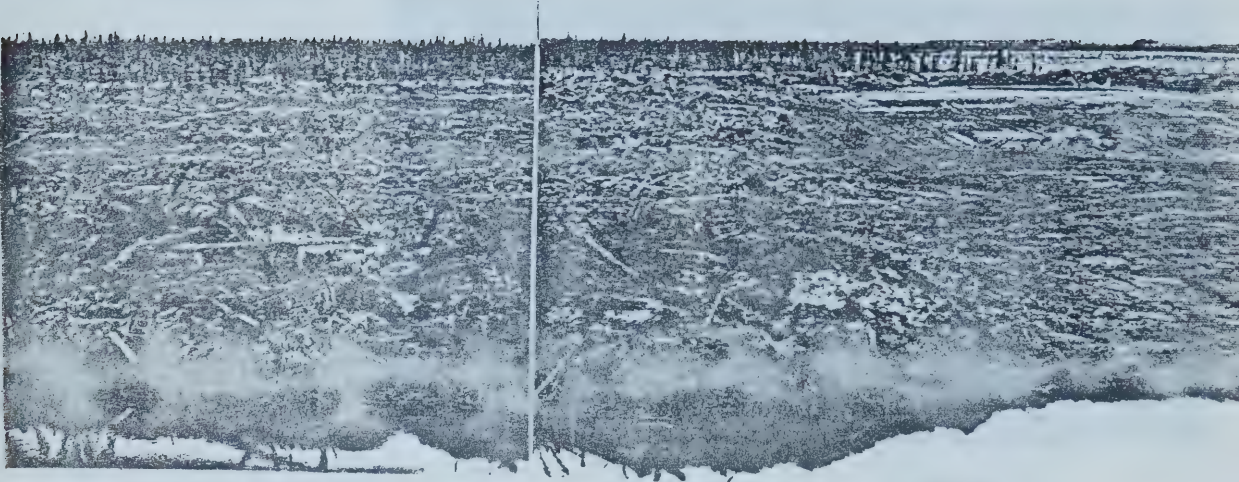


Fig. 7 Land has been cleared, windrowed, and the roots have been picked on the east side.

3. windrowing (frozen ground) See Fig. 7
4. root clearing (using cats and heavy cultivator in mid-summer) See Fig. 7
5. lateral ditching See Fig. 8 and 9.

Fig. 8 "Lateral
ditching"

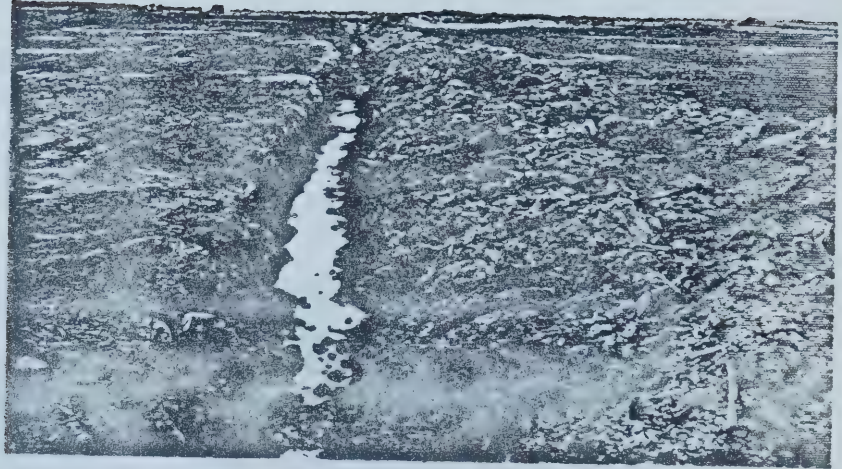


Fig. 9 "Lateral
ditching"

6. harrowing to loosen the top 2 inches (heavy, vibroshank harrows)
7. sun drying
8. peat pick-up (using mobile vacuums) or rakes and front-end loaders. See Fig. 10

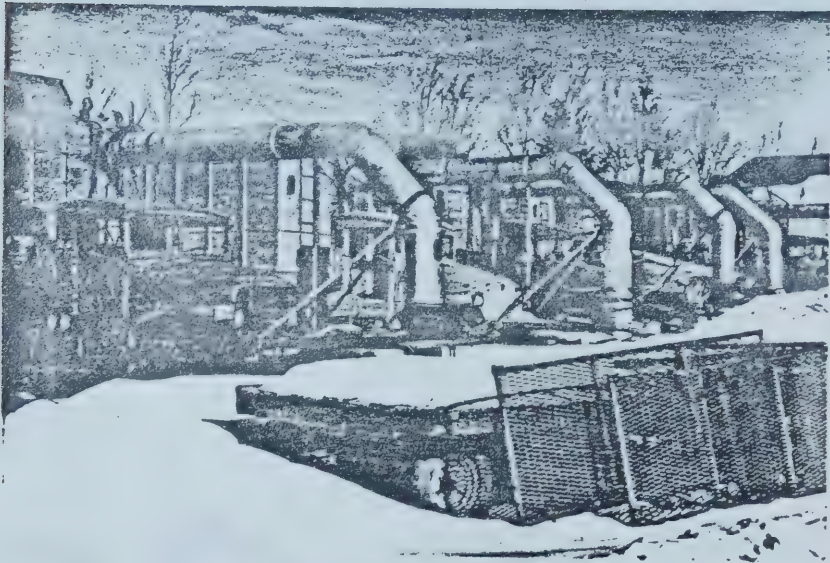


Fig. 10 Mobile vacuums used for picking up peat

9. stockpile for plant feed. See Fig. 11 and 12.

Fig. 11

Peat stockpile
for plant feed
(before root
removal)



Fig. 12

Peat stockpile
for plant feed
(after root removal)

The bulk of commercial peat mineable by this method is in about the top four to six feet after drainage. Vacuuming removes about 2 inches each pass and may be used several times in a summer, depending on rainfall. It takes about two days of drying for each $\frac{1}{4}$ inch of rainfall before vacuuming may occur. The disadvantages of this system of excavation are as follows:

1. Drainage ditches required 2 to 5 years before peatland may be entered. These must be maintained at spacing of about every 125 feet 18" wide 4' deep.
2. Mining is totally dependent upon weather conditions. Continuous feed to plant is not ensured.
3. Peatlands settle as much as 40% after being drained. Drainage in excess will deteriorate the peat.
4. Relying on sun drying gives rise to the problems of overdrying the product, or at least not maintaining a consistent moisture level in the product.

B. Drag-line Operations

This method again requires preliminary drainage and clearing so that heavy equipment, with all necessary access roads, may operate for as much of the year as possible. It is mainly a frozen-ground operation and is used primarily for plant feed during the winter months. Depths exceed those obtainable by surface vacuuming. Artificial drying is mandatory. This system is used to complement plant feed supply by the vacuum method in dry excavation operations in the province. It's disadvantages are:

1. Access roads cut up peatlands and may restrict lateral water flow.
 2. Reclamation costs are high as water problems appear.
- Figures 13, 14, and 15 indicate the drag-line operation quite well. The piled peat is removed by trucks and is taken to the plant.



Fig. 13



Fig. 14



Fig. 15

C. The Wet Method

This method differs from the two above in that it does not require local drainage. In fact it is completely dependent upon the retention of water in the peat deposit for flotation. It basically entails the use of low head pumps which transfer peat from the bog to a processing plant, where the material is cleaned, dried, and bagged. The use of a heated storage reservoir would allow the plant to continue operating on a year-round basis, thus ensuring a continuous flow of production. The land form resulting from this type of operation would be shallow lakes.

The advantages of this system of excavation are as follows:

- (1) Can be used in wet bogs if drainage is difficult.
- (2) Is not dependent on dry or warm weather.
- (3) Total horsepower requirements are reduced.
- (4) Roads are not required throughout the bog for access.
- (5) Peat can be extracted to greater depth.

The disadvantages are as follows:

- (1) It is doubtful that the small, irregular lakes resulting from hydraulic extraction would be of great enough size, purity and aesthetic quality to be used much for fish or recreation.
- (2) A heated reservoir must be maintained throughout the winter as a stockpile source for plant operation.

The processing plants in Alberta are in various stages of refinement. The major stumbling block, mechanically speaking, is finding an acceptable drying technique for product quality control.

Basically, a commercial peat processing plant consists of equipment to handle the following stages:

- (1) root and bark removal - mainly by screening
- (2) dryers and sterilizers

- (3) bagging operation
- (4) storage and shipping

Examples of some Alberta operations are indicated in the following figures (16 to 21).

Fig. 16

Peat enters the
dryer-sterilizer
at Banff Mining
& Quarrying,
Evansburg, Alta.

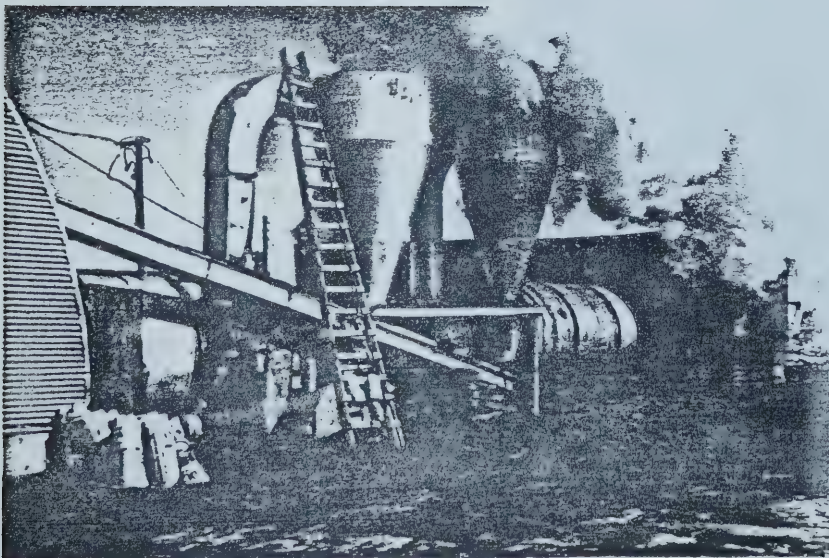
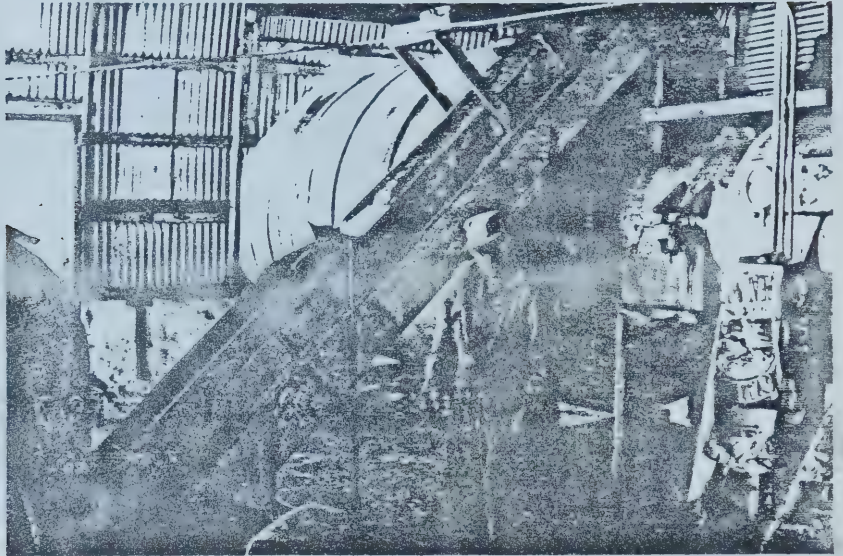


Fig. 17

Dryer assembly
Banff Mining &
Quarrying,
Evansburg, Alta.



Fig. 18

Bagging Machinery in
operation. Banff Mining
& Quarrying, Evansburg.

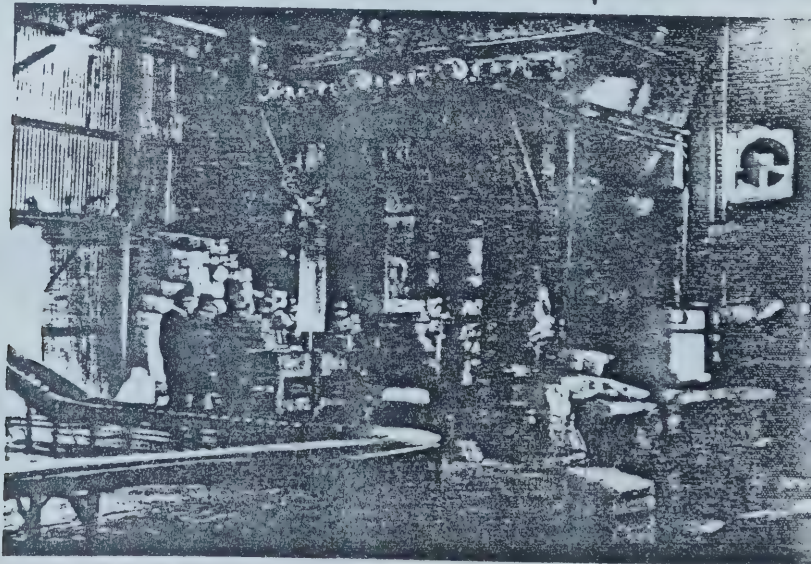


Fig. 19

Bagging area,
storage facilities,
and shipping docks.
Banff Mining &
Quarrying, Evansburg.



Fig. 20

Loading Docks.
Banff Mining & Quarrying,
Evansburg, Alberta



Fig. 21

New facilities of
Baycroft Peat
operation, includ-
ing high volume,
low temperature
drier.

IX.

RECLAMATION OF EXCAVATED PEATLANDS

To date in Alberta there has been very little thought given to reclamation of mined-out peat bog areas. In Quebec, the depth of most peat deposits is such that mineral soil is quickly uncovered and can be used for agricultural purposes. This also has been the case on part of Banff Mining and Quarrying's holdings. See Figures 22, 23 and 24.

Figs. 22 - 24

Part of Banff
Mining & Quarry-
ing's operations.



Fig. 23

Reclaimed peatland.
This was an area of
shallow peat and it
was reclaimed as
hayland.



Fig. 24

Most present developments and potential areas in the province, however, are deeper bogs. Because of this extensive areas very likely will not be reclaimable for agriculture and will require decisions as to what future land use possibilities there are. Commercial areas within the Green Zone may be best reclaimed to standards suitable for the establishment of commercial timber crops. Reforestation and/or afforestation should be considered as an alternate land use as silviculture techniques could be refined to meet this objective. As well, we have to consider the limitations of climate and geography when planning future land use.

With planned management of the removal of peat moss within a region the environmental impact felt as a direct result of the operation could be minimal or perhaps even beneficial for the area. There are two areas where perhaps some benefit could be derived.

1. Drainage of a bog area may reduce water tables in the surrounding locality to the extent that agriculture or some other land use may be more possible.
2. Areas that are mined by the wet method have potential as improved wildlife habitat and possibly for fish. They may continue to function as watershed protection areas.

Peatlands and Watershed Management

1. Peatlands are saturated most of the time and therefore act as storage sites for "Dead" water. They may release water gradually throughout the growing season. Drainage ditches increase the mobility of this stored water and it is discharged from the peatlands in a more continuous, regulated manner. During dry periods, peatlands with drainage ditches show a higher and more regular runoff than undisturbed ones, where the runoff often completely dries up. Therefore it does not hold that an undisturbed peatland is able to supply streams and rivers with additional water from its water reserves during periods of drought. These reserves are not available for runoff; they comprise more or less "dead" water. The drained peatland, on the other hand, is able to supply, even over a long period, sustained low-water runoff by means of its ground water reserves which are mobilized by drainage installations.
2. Peatlands are generally not the source of water. They have an inlet and an outlet and serve as a storage reservoir only. To remove a saturated peatland would only increase the rate of inflow and outflow slightly in the long run. However, drainage ditches would decrease the storage capacity of the peatland. Until drainage was complete, the outflow volumes of water would be increased, and may have considerable downstream effects.
3. They tend to act as buffers along a stream and greatly damp out seasonal fluctuations in head.
4. Removal of large peatlands will have a local effect on the surrounding water levels.
5. Commercial harvesting of peat will undoubtedly reduce the volume and retention time of water, reduce the head, and therefore will increase the amount of water moving through a peatland. The

magnitude of this effect will be proportional to the area harvested. The seriousness of this will depend upon the water table conditions in the adjacent areas.

6. Removal of peat by dryland or dragline techniques will undoubtedly have more drastic effects on the water table and groundwater upstream and downstream than will excavating by the wet method.

Peatlands and Wildlife Management

At best, commercial peat operations could provide:

- A. Dryland Excavation (with drainage)
 1. increased and improved grazing for upland species
 2. more favourable footing
- B. Wet Excavation (small lakes)
 1. improved habitat for waterfowl and perhaps fish

However, some trees will undoubtedly be removed during operations and carrying capacity for species native to these wetland environments will, in the long run, be adversely affected.

As well, a case could perhaps be made to demonstrate that the net energy gained after excavating, transporting, and using our peat resources could well be far below the energy gained by wildlife users.

X.

PROVINCIAL PEAT INVENTORY BY GOVERNMENT

Our peat resources are immense at this point in time, and a provincial inventory seems unnecessary. Besides being impractical and costly, it could take years and still not provide the necessary detailed information. It could be undertaken on a limited basis according to:

- (1) economic constraints (e.g. distance from transportation network and natural gas sources)
- (2) area concentration by interested developers.
- (3) need for specific product for specific end use in areas where probability of success are high (e.g. specific horticultural requirements for pH, ash content, and water retention properties).

As all bogs are not the same, and as conditions within any one bog may vary, every bog would have to have core samples taken, and these tested against standards for commercial peat.

Most arguments, at this time, are against efforts to set up a provincial peat inventory. However, it may be feasible now to do the following:

- (1) Compile a map of potential commercial peat areas from existing soil maps and then send developers out to do their own sampling and testing to locate potentially commercial areas.
- (2) To further coordinate private peat testing and sampling by adopting accepted testing standards and documenting each set of results obtained. This is similar to the oil and gas situation where the ERCB sets standards and collects data from private developers. Suggested testing results should include:
 - (a) identification of peat types from core hole data,
 - (b) log data, including pH, strata, depths, texture (degree of decomposition),
 - (c) area considered for commercial operation,
 - (d) estimated raw volume of marketable product,
 - (e) drainage pattern of the peatland.

This information, once documented could suggest to government that there may be certain key areas in the province that should be investigated in some detail in order to provide information to industry and government that would facilitate expansion and growth of the industry. Most of these areas could be delineated on an economic basis (distance to markets, etc.).

Within this broadly outlined area, experimental areas could be set up to determine:

- (a) classification of peats
- (b) stage of decomposition
- (c) depth variability
- (d) chemical properties
- (e) physical properties

Such detailed information would not only be useful to industry, but would also serve to assess the areas in terms of potential agricultural production, construction, forestry, etc.

XI.

RECOMMENDATIONS

1. Any extraction operation should include a development and restoration plan prior to commencement. Any developer should also be required to furnish market feasibility studies for his particular product, financing capabilities and management experience. This would reduce the number of firms interested in speculation rather than development.
2. Operating plan should include proposed method of recovery, volume to be recovered, processed, and sold, drainage schemes if any, estimated volume of saleable material in the area under application, plant size and number of employees. Transportation facilities and source of power should also be included, as well as the approximate intended production rate in order that the size of the lease bears some relation to the proposed production and the term of the lease.
3. The government should have some idea of the amount of peat available in areas applied for. This means that the government do exploration in highly potential areas or else require that private exploration results be recorded within government agencies.
4. In order to ensure that large areas of peat lands are not tied up without development, the government should ensure that continuous development of these areas is carried out by the lessee or that a rental is paid which would discourage speculation by companies who may wish to lease unreasonably large areas of land.
5. If the peat moss industry develops as an important economic input to the province, it seems only fair that certain facilities should be provided by the province. Thus, it may be necessary to provide road access to areas where major production operations have been approved. In the Green Zone, of course, this precedent should not be set.

6. Reasonable lease fees and royalties should be re-established.
7. From calculations presented in this report it appears that a suitable lease size for development should not exceed 160 acres. This lease size, at present excavation rates, should last 16 years.
8. Before commercial peat development leases are approved, the impact of each operation on the particular watershed must be thoroughly considered. This suggests an interdisciplinary effort using suitable referral procedures and the Development and Reclamation Committee.
9. Some detailed experimentation and field observations are required to determine the importance of peatlands in watershed management. There is a great deal of feeling in the literature that the importance of peatlands has been overexaggerated. Hydraulic conductivity variations are very apparent among different types of peat, and the relationships of peatlands to groundwater is not clear.
10. There are problems regarding the revegetation of surface mined areas (tar sands, coal strip mines, etc.) and considerable research is still required. Perhaps the use of commercial peat in the revegetation program could provide some of the answers. If peat is required for this purpose, there may be significant impact on the market. This area should be further investigated.

